RC4 Wireless Lights It Up with Tektronix MSO2000 Series

Customer Solution Summary

August 2009

Challenges

- To quickly and accurately debug hardware and software in custom-designed wireless dimming modules and transmitters used in controlling the lights of live theater productions.

Solution

- A Tektronix MSO2024 mixed signal oscilloscope with application modules for serial bus triggering and analysis.

Results

- With the functionality to see both the decoded serial packets and analog signals simultaneously, RC4 Wireless is able to identify problems in literally a few minutes, without the need to build special test fixtures or time-consuming trial and error.

The chandelier in Cirque du Soliel Corteo, is battery-powered and radio controlled in real-time using an RC4Magic Wireless Dimming system. The RC4 wireless link is transparent to the lighting designer, providing the same immediacy of control found with wired fixtures elsewhere in the production.

Photo:Richard Termine; Costume: Dominique Lemieux; © 2008 Cirque du Soleil

Wireless Stage Lighting

Modern stage lighting is a critical tool in the production of theater, dance, opera, and many other performance arts. The precise interplay of lights and action are critical to directing audience focus, setting mood or controlling the perception of shapes on stage. Increasingly, with the growth of digital technology, modern lighting instruments allow remote control, not just of intensity, but of direction, color, beam shape, projected image, beam angle and a wealth of other effects.

With the ability to control lights comes the question of how to deliver dimming instructions from the lighting console to lights that are often dispersed across the set or, in the case of Cirque du Soleil performances, on performers themselves. For a growing number of lighting designers, the best way to achieve the flexibility and rapid set-up they need is to use a wireless link in place of cumbersome data cables.

One of the leaders in this specialized market segment is RC4 Wireless Dimming (www.theatrewireless.com), which develops a complete family of off-the-shelf and custom wireless dimming and control products for the arts and entertainment industry. One of the company's most popular products is the RC4Magic Series 2 that replaces DMX cables in lighting control applications. DMX is an EIA-485 based communications protocol commonly used to control stage lighting and effects.

Flawless Performances

Delivering wireless DMX dimmers to this customer base is no easy task. Big shows are expensive to stage and customers paying top dollar to attend events expect flawless performance after flawless performance. That means RC4's wireless products have to operate without latency and match the reliability and ease of operation of a wired DMX connection. An additional challenge is the growing demand for compact, battery-powered units.

A wider view of the Cirque du Soliel Corteo stage shows the clean lines achieved by avoiding electrical wiring, while still providing a sophisticated light show. Traditional wired control is used for conventional lighting on trusses overhead and elsewhere. Wireless lighting on the mobile pieces seamlessly integrate into the overall design.

The wireless lighting control in numerous productions by Opera Australia enables extremely fast scene changes. The elimination of trailing cables allows pieces to fly out of scene in any direction at any time. In today's theatre world, audiences seek an experience rivaling the fast edits and point-of-view changes of film and video. Wireless is one of the most powerful facilitators to meet this demand.

Photo is a scene from The Tales of Hoffmann. Photo courtesy of Opera Australia.

Beyond the demanding fundamental design challenges, RC4 faces the same challenge as many engineers who strike out on their own to build a business – not enough time in the day. James Smith, RC4 President and Product Designer, handles everything from gathering specifications for new customer orders to hardware and software design to customer support. To be sure, more than a decade experience in this industry helps Smith to get more done in a day than a newcomer might accomplish in a week.

With steady growth and a flow of new custom design requests from the likes of Cirque du Soleil and Disney among others, Smith was finding he was reaching the limit. Many of these customers want to create new and exciting props that have never been done before, and that means elaborate new lighting effects. One of his biggest obstacles was the ability to quickly isolate “nagging” problems in some of his embedded designs.

Trouble with Troubleshooting

“We are able to stay successful in this business because we can move quickly. It’s not uncommon for us to have just three months to invent a new product and end up with something that is reliable, rugged and durable in end-user packaging,” Smith relates. “We have the classic small business problem. It’s difficult to juggle everything and saving time whenever possible is crucial. I really can’t afford to spend a lot of time troubleshooting.”

But, in fact, troubleshooting consumed many hours and days. The problem stemmed in part from Smith’s older test equipment: a couple of 10-year-old oscilloscopes and a simple test device for looking at DMX data. When it came time to determine the source of the problems, Smith often found himself resorting to time consuming trial and error. As designs have gotten more complex with advancing technology and customer needs, elusive errors can occur anywhere across wireless devices, in receivers or transmitters and they can be hardware or software related.

Viewing data streams required painstakingly decoding highs and lows on-screen by eye. The older oscilloscopes could only capture and hold one small monochromatic screen worth of information. If the view was too wide, he couldn’t distinguish the individual bits and their timings; if the view was too narrow, he could only see a portion of a byte or a packet. Changing the time base cleared the screen, requiring the event to be recaptured to analyze it further.

For complex Serial Peripheral Interface (SPI) data, he was not able to look at all pertinent data lines at the same time since the older units only had 4 input channels that were alternately sampled in pairs. “This usually meant that I would look at 2 lines, make notes, look at 2 other lines make further notations and so on. Finding brief timing anomalies where, say, one edge was rising slightly early or falling slightly late was often impossible. That’s where hypothesis, trial, and error became a big part of my routine,” Smith explains.

“I looked at some newer scopes, but I wasn’t seeing anything out there that would make a big difference for me. And scopes with more advanced features were out of my price range.”

That changed when he learned about the MSO2000 Mixed Signal Oscilloscope Series and its advanced debug features and entry-level price. The MSO2024 he selected provides 16 digital channels, in addition to four analog channels. The many channels are especially useful for quickly spotting those timing anomalies without the need for a notepad.

"When the scope arrived, I immediately opened the box and went to work. I didn't even touch the manual. Within minutes I had lines named and labeled."

James Smith
President and Product Designer, 4RC

Pulling the Trigger

For Smith's needs, the DPO2EMBD serial triggering and analysis application module for automated decoding and triggering on SPI buses and the DPO2COMP application module that enables the same for RS-232 were game changers. The trigger capability allows him to isolate particular bus traffic of interest, while the decoding capability lets him instantly see the content of every message transmitted over the bus in an acquisition.

"In the past I might have spent hours getting a simple scope appropriately set up, then spent more time finding ways to force a particular event to trigger the scope at the right time," Smith says. "All that time is now replaced by a few short minutes capturing and reviewing an extended sample of real-world data, both visually and numerically. Now, an anomaly can literally jump right out at me, and be verifiably fixed moments later."

Another important factor was intuitive menus and operation, which meant that Smith could quickly get to work solving real problems.

"When the scope arrived, I immediately opened the box and went to work. I didn't even touch the manual. Within minutes I had lines named and labeled," Smith says. "I had a problem with sporadic, intermittent package loss on a product under development. So I plugged in the new scope to see what was going on and saw that the first two bytes on the screen were not reflected correctly in the software, showing that it absolutely was a software problem. I could have gone for days unwilling to believe it was my software…I quickly found a mistake in the firmware."

Smith adds that he was so excited by this addition to his bench that he "took a picture of the scope and emailed it to my technical associates. I couldn't have had a better first day with a tool."

Since then, Smith has found the Tektronix oscilloscope to be a valuable diagnostic and development resource. In contrast to the older oscilloscopes, the MSO2024 can capture a very long segment of data from many input samples. The instrument's Wave Inspector® controls allow Smith to zoom in on this data after the capture is taken for detailed and precise analysis.

For RC4, the MS2024 not only dramatically improves current bench strength, but will also enable the firm to move forward as stage and entertainment lighting technology evolves past the older DMX protocol to embrace technologies such as powerline-based controls and more sophisticated protocols. The future looks bright indeed.

08/09 AH/WWW 3GW-24465-0